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NATIONAL SENIOR CERTIFICATE

GRADE 12

AGRICULTURAL TECHNOLOGY

MARKING GUIDELINES

NOVEMBER 2023

MARKS: 200

These marking guidelines consist of 16 pages.

SECTION A**QUESTION 1**

1.1 1.1.1 B✓✓

1.1.2 A✓✓

1.1.3 D✓✓

1.1.4 B✓✓

1.1.5 D✓✓

1.1.6 C✓✓

1.1.7 A✓✓

1.1.8 D✓✓

1.1.9 A✓✓

1.1.10 B✓✓

(10 x 2) (20)

1.2 1.2.1 differential ✓✓

1.2.2 helical ✓✓

1.2.3 biological ✓✓

1.2.4 perforated ✓✓

1.2.5 electric arc ✓✓

(5 x 2) (10)

1.3 1.3.1 D✓✓

1.3.2 F✓✓

1.3.3 G✓✓

1.3.4 E✓✓

1.3.5 C✓✓

(5 x 2) (10)

TOTAL SECTION A: 40

SECTION B**QUESTION 2: MATERIALS AND STRUCTURES**

2.1 TWO types of water troughs. Water trough A is made from fibre glass and B from concrete.

2.1.1 A synthetic material except fibre glass that can be used to manufacture a water trough.

- Plastic.✓
- PVC water trough.✓
- Polypropylene.✓

(Any 1) (1)

2.1.2 TWO reasons why A would be preferred above B.

- Lightweight.✓
- Watertight.✓
- Easy repair.✓
- Easy to colour.✓
- Easy to mould.✓
- Easy to drill and sand.✓

(Any 2) (2)

2.1.3 The device that will be installed into the trough to allow water to flow into the trough when the water level drops.

Ball valve.✓

(1)

2.2 An example of a typical adhesive.

2.2.1 The meaning of load capacity of an adhesive.

The adhesive should be able to withstand mass✓ and tension.✓

(2)

2.2.2 Improving the adhesion properties of an adhesive.

- Apply a thin base coat if the surface is very porous.✓
- Apply only a thin layer of adhesive.✓
- Apply adhesive to both surfaces.✓
- Too thick layer of adhesive will result in a weak joint.✓

(Any 2) (2)

2.3 Different synthetic materials.

2.3.1 327 °C.✓

2.3.2 Melt.✓

2.3.3 Non-stick coatings✓, Valves✓, Taps✓, Tape.✓

(Any 1) (3)

2.4 TWO effects of nickel on stainless steel.

- It improves the amount of toughness.✓
- It gives steel a fair amount of toughness at low temperatures.✓
- Nickel helps to increase the hardening ability of steel.✓
- Steel which is alloyed with chromium and nickel is resistant to corroding agents (air, water, chemical acids and alkali).✓ (Any 2) (2)

2.5 A brass bush.

2.5.1 TWO metals that are used to manufacture brass.

- Copper.✓
- Zinc.✓ (2)

2.5.2 TWO permanent joining methods that incorporate heat used to join brass.

- Soldering.✓
- Brazing.✓ (2)

2.5.3 TWO benefits of brass alloy bush when it is compared to pure copper bush.

- The alloy becomes harder than copper.✓
- It is more easily casted than copper.✓ (2)

2.6 THREE reasons why a Vesconite bush is preferred to a ball bearing.

- Easy to fit and remove.✓
- Does not corrode.✓
- Will not wear shafts & liners like traditional bearing materials.✓
- Resistant to a wide range of chemicals.✓
- Does not shrink or expand.✓
- Does not wear.✓
- Will not damage the shaft.✓
- Easy and safe to machine.✓
- Low friction abilities.✓
- Vesconite does not delaminate.✓
- Vesconite remains hard.✓ (Any 3) (3)

2.7 An electrical fence.

2.7.1 The depth to which the earth electrode must penetrate the soil when a high output energizer is used.

1m. ✓ (1)

2.7.2 A cost-effective method that can be used to protect the steel posts against corrosion.

- Galvanising.✓
- Paint.✓
- Powder coating.✓

(Any 1) (1)

2.7.3 THREE causes of short circuits on an electrical fence.

- Vegetation touching the fence.✓
- Faulty joints.✓
- Broken wires.✓
- Faulty insulators.✓

(Any 3) (3)

2.7.4 Why copper is a suitable material to manufacture the earth spikes used in an electric fence.

- Good conductor of electricity.✓
- Does not corrode.✓
- Durable.✓
- Readily available.✓

(Any 3) (3)

2.8 A farmer needs to install an electrical fence with six strands of wire with a perimeter of 300 meters.

Posts:	6 x R180.00	= R 1080.00✓
Droppers:	100 x R13.00	= R 1300.00✓
Wire:	(6 x 300m) x R1.50	= R 2700.00✓
Isolators:	((6 x 100) + (6 x 2) + (4 x 6 x 2)) x R5.00	= R 3300.00✓
Total:		<u>= R 8380.00✓</u>

(5)
[35]

QUESTION 3: ENERGY**3.1 Alternative fuels.**

3.1.1 Starch,✓ sugar crops,✓ maize,✓ sorghum,✓ potatoes,✓ wheat,✓ sugarcane,✓ cornstalks,✓ fruit,✓ or vegetable waste.✓ (Any 1) (1)

3.1.2 Methanol.✓ (1)

3.1.3 Waste products such as sewage,✓ manure,✓ earth gas,✓ or landfills.✓ (Any 1) (1)

3.2 The construction of a wind turbine.

3.2.1 Name of part A.

Generator.✓ (1)

3.2.2 Description of the function of part B.

- To ensure optimum torque output to the generator.✓
- To increase the rotation speed of the output shaft.✓ (2)

3.2.3 The part that is installed on a wind turbine to measure wind speed.

Anemometer.✓ (1)

3.2.4 Description of the effect that the change of the pitch of the blades has on the wind turbine.

- Protects the wind turbine against strong winds.✓
- More electricity can be generated from slower winds.✓ (2)

3.3 A solar system.

3.3.1 FOUR aspects that have a negative influence on the efficient generation of electricity by the solar panel system.

- Panels facing the wrong direction.✓
- Clouds obstructing the sun rays.✓
- Trees obstructing the sun rays.✓
- Dirt covering the panels.✓
- Broken panels/malfunction panels.✓
- Too few solar panels.✓ (Any 4) (4)

3.3.2 Explanation to a farmer why a solar system is preferred.

- No load shedding issues/no electricity interruptions.✓
- No load reduction.✓
- Green energy.✓
- No distribution network required/no line fees.✓
- No monthly electricity bills.✓
- No cable theft issues.✓

(Any 3) (3)

3.3.3 THREE protective measures that can be installed to protect the solar system against theft and vandalism.

- CCTV camera monitoring.✓
- Electric fence.✓
- Anti-theft brackets/mountings.✓
- Razor wire.✓

(Any 3) (3)

3.4 Precautionary measure that should be taken to avoid overcooling of a geothermal energy plant's heat source.

Do not pump too much water into the hole.✓

(1)
[20]

QUESTION 4: SKILLS AND CONSTRUCTION PROCESSES

4.1 Safety is one of the most important aspects when performing tasks in the workshop.

4.1.1 FOUR safety equipment that needs to be present before performing a task in the workshop.

- Safety/ welding screens.✓
- Fire extinguisher.✓
- Appropriate personal safety equipment.✓
- First aid.✓

(4)

4.1.2 FIVE ways by which a farmer can limit risks and improve the safety of workers when working with gas equipment in a workshop.

- Adequate orientation and training with reference to tools and equipment.✓
- Provide correct personal safety equipment.✓
- All tools and equipment in good working order.✓
- All safety screens in place and in good working condition.✓
- Fire extinguishers serviced and in place.✓
- Emergency plan and numbers in place.✓
- Dangerous/ hazardous items locked away.✓
- Safety signs in place.✓
- Bottles correctly stored and secured.✓

(Any 5)

(5)

4.1.3 Explanation why it is not advisable to perform tasks alone in the workshop.

- If you were to get hurt or electrocuted no one will be near to assist.✓
- Certain tasks require assistance.✓

(2)

4.2 TWO types of welding machines.

4.2.1 Identification of welding machines A and B.

- A- M.I.G/ CO² welder.✓
- B- Inverter/ Arc welder.✓

(2)

4.2.2 Motivation of which welding machines would require more technical skills to work with.

A✓ More electronical/technical components and settings to adjust.✓

OR

B✓ Difficult to learn to weld with this welder. The welding electrode is constantly becoming shorter.✓

(2)

- 4.2.3 Explanation of why it is not advisable to weld with welding machine A in an open field on a farm.
- The use of shielding gas makes this type of welding less portable than arc welding.✓
 - The shielding gas can be blown away in windy conditions.✓
 - Less portable machine.✓ (Any 2) (2)
- 4.3 4.3.1 Direction of the threaded connector.
Clockwise.✓ (1)
- 4.3.2 Identification of the part of the component that indicates the rate in which the gas flows.
A✓ (1)
- 4.3.3 Indication of the defect that will occur when the gas working pressure is too low.
- Porosity on the weld.✓
 - Air bubbles on top of the weld.✓ (Any 1) (1)
- 4.4 Common welding defects.
- 4.4.1 Lack of penetration.✓ (1)
- 4.4.2 Higher current setting.✓ Larger root gap.✓ Smaller root face.✓
Correct alignment of plates.✓ (Any 1) (1)
- 4.4.3 Higher voltage setting/ pre-cleaning of metal with grinder/ keep the gun closer to the work piece.✓ (1)
- 4.4.4 Wire feeder speed too high.✓ (1)
- 4.5 Identification of the parts in the MIG welding diagram.
- A- Contact tip.✓
B- Welding wire.✓
C- Shielding gas.✓
D- Weld pool.✓
E- Welding run.✓ (5)

- 4.6 4.6.1 Indication and a reason of the correct angle of the welding electrode in relation to the work piece when welding a T-joint.
45 degrees.✓ To prevent undercutting,✓ to ensure efficient fusion of metals.✓ (Any 1) (2)
- 4.6.2 TWO methods to prevent shrinking and distortion when welding the two pieces of metal.
- Spot welding.✓
 - Lap welding.✓
 - Pre-setting.✓
 - Clamping.✓
- (Any 2) (2)
- 4.7 Explanation of the types of metal deterioration:
- 4.7.1 Friction.
Metal on metal friction/rubbing.✓ (1)
- 4.7.2 Metal fatigue.
Continuous flexing/vibration of a metal part.✓ (1)
- [35]**

QUESTION 5: TOOLS, IMPLEMENTS AND EQUIPMENT

5.1 5.1.1 THREE personal protective equipment that must be worn when working with the brush cutting machine.

- Sturdy steel-toed work boots.✓
- Long pants and long-sleeve shirts protect from flying debris, grass clippings and the sun.✓
- Use safety glasses, goggles or shields especially when mowing near solid objects like gravel driveways.✓
- Ear protection is highly recommended during mowing.✓

(Any 3) (3)

5.1.2 FOUR safety tips when working with the brush cutting machine.

- Read and understand the operator's manual and become familiar with the machine.✓
- Remove all debris from lawns before mowing.✓
- Use recommended PPE including close-fitting clothing when operating an edge cutter.✓
- Keep all guards and safety shields in place.✓
- Never disengage any safety interlock switches.✓
- Never refuel the edge cutting machine when the engine is hot or running.✓
- Store gasoline in an approved container with proper label.✓
- Turn off the motor before cleaning the area under the safety screen.✓
- Disconnect the spark or electric plug before trouble-shooting or repairing the cutting machine.✓
- Perform routine maintenance according to the schedule recommended by the manufacturer.✓
- No bystanders and pets near a running cutting machine.✓

(Any 4) (4)

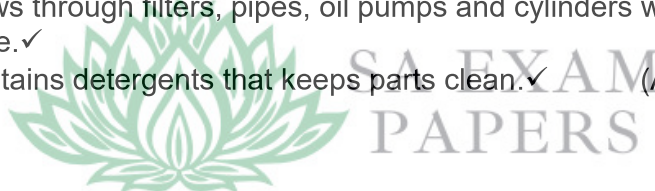
5.2 5.2.1 Identification of the type of hydraulic cylinder.

Double-action hydraulic cylinder.✓ (1)

5.2.2 FOUR advantages of the transmission oil that is used in the hydraulic cylinder.

- Not compressible.✓
- Good lubrication qualities.✓
- Remains liquid over a large temperature range.✓
- Not volatile.✓
- Relatively cheap.✓
- Flows through filters, pipes, oil pumps and cylinders with ease.✓
- Contains detergents that keeps parts clean.✓

(Any 4) (4)



5.3 5.3.1 Explanation why V-belts are preferred over flat belts.

- V-belts do not easily slip off pulleys.✓
- V-belts draw tighter round pulleys when tension increases.✓
- Lubrication is not necessary.✓
- V-belts are relatively strong, and under normal circumstances do not easily break.✓
- Cold, moist conditions, age or use do not cause V-belts to stretch or shrink.✓
- V-belts last longer than flat belts.✓
- If the pulleys over which a flat belt run are not aligned accurately the belt is thrown off.✓
- If flat belts are not lubricated regularly, they tend to slip on pulleys.✓
- When flat belts are put under extreme tension, they easily slip off a pulley or break.✓
- A flat belt is subject to stretching and/or shrinking.✓

(Any 3) (3)

5.3.2 Calculation of the speed of pulley B on the pulley drive system.

$$N_a \times D_a = N_g \times D_g$$

$$100 \times 300 = N_g \times 120 \checkmark$$

$$30000/120 = N_g \checkmark$$

$$N_g = 250 \checkmark \text{ r/min} \checkmark$$

(4)

5.3.3 Name of pulley C and its function.

- Tensioner pulley/ Jockey pulley.✓
- The tensioner pulley uses the spring✓ to put the correct tension on the V-belt to prevent the belt from slipping.✓

(3)

5.4 Problems associated with the hitching of an implement.

5.4.1 Turn the top link to make it longer.✓

(1)

5.4.2 Use the levelling box to level the implement to the tractor.✓

(1)

5.4.3 • Lower hitching point.✓

• Install counterweights at the front end of the tractor.✓

(1)

(Any 1)

5.5 5.5.1 Identification of the type of round baler with a reason.

- Vermeer type baler.✓
- The baling chamber uses belts to form the bales.✓

(2)

5.5.2 Reasons for installing a slip clutch on the power take-off shaft of the round baler.

- Prevents heavy objects from being taken into the baler.✓
- Protects the pick-up if it is impeded by anything.✓
- Protects the auger if it becomes overloaded.✓ (Any 2) (2)

5.5.3 FOUR tasks that must be completed when preparing a baler for the baling season.

- Check all safety clutches.✓
- Sharpen all blades.✓
- Check tires pressure.✓
- Check bolt tension.✓
- Inspect chassis and tires for damage.✓
- Lubrication.✓
- Check all bearings, chains and gears.✓
- Check the tension on the belts and chains.✓
- Make sure all safety screens are in place.✓ (Any 4) (4)

5.5.4 How to prevent bales from rolling away when baling against a slope.

Always position✓ the baler correctly before ejecting the bale from the bale chamber.✓ (2)

5.6 5.6.1 Description of the working of the combine harvester when cutting the wheat.

- The whole plant is fed into the thresher by the conveyer chain.✓
- The hammers, blowers and sieves strip the grain and separate the chaff.✓
- Wheat grains are collected in a bin inside the harvester.✓
- Chaff is blown out at the back and can be collected for animal feed.✓
- When full, the wheat is transferred to a truck.✓ (Any 3) (3)

5.6.2 Explanation of the disadvantage of not setting a combine correctly before harvesting the wheat.

- Wheat losses may occur due to sieves set incorrectly.✓
- Wheat not removed from the ears.✓
- Wheat is blown out by the blower of the machine.✓
- If the drum speed is not correctly set, the combine may also break the wheat.✓ (Any 2) (2)

[40]

QUESTION 6: WATER MANAGEMENT

6.1 6.1.1 Advantages of the irrigation sprinkler.

- Prevents over-irrigation.✓
 - Prevents under-irrigation.✓
 - Increase yields by precisely applying water where it's needed.✓
 - Water is equally distributed over the land.✓
 - Restricts water to soils with greater water holding capacity (e.g. Clay soil).✓
 - Maintains concentration of injectable (fertigation/herbicides).✓
 - Reduces irrigation costs.✓
- (Any 3) (3)

6.1.2 TWO types of materials that can block or obstruct the irrigation sprinkler.

- Fertilizers.✓
 - High lime content water.✓
 - Organic material.✓
 - Rust.✓
 - Debris.✓
 - Mud/sand.✓
- (Any 2) (2)

6.1.3 A device that can be installed in the irrigation system to prevent blockages.

Filter.✓ (1)

6.1.4 A device that can determine if irrigation is needed by the crop.

Soil moisture probe/sensor.✓ (1)

6.2 Preventing a centre pivot irrigation system getting stuck.

- Prevent over irrigation.✓
 - Tyres with mud tracks.✓
 - Gravel or rocks in furrows.✓
 - Wider wheels.✓
- (Any 2) (2)

6.3 A term that is used to describe the correct frequency and duration of irrigation in a field.

Irrigation scheduling.✓ (1)

6.4 Explanation of evapotranspiration and the name a device that is used to measure it.

- Evaporation of water from the soil and plant surfaces into the air.✓
 - Evaporation pan.✓
- (2)

6.5 6.5.1 The purpose of the two round structures on top of the septic tank.

- Manholes for inspection.✓
- Manholes for cleaning of the septic tank.✓
- (Any 1) (1)

6.5.2 THREE types of matter that accumulates in the first compartment of this sewerage treatment system.

- Solids.✓
 - Raw sewage.✓
 - Liquefied solids/sludge.✓
 - Semi-solid scum (fats, oils).✓
- (Any 3) (3)

6.5.3 TWO maintenance tips that must be carried out on the septic tank.

- Septic tank should be cleaned before the sludge level gets high.✓
 - Live bacteria should be in the system at all times.✓
 - When the system overflows, it should be emptied.✓
- (Any 2) (2)

6.5.4 The functions of useful bacteria in a septic tank.

- The bacteria's job is to digest all organic waste matter.✓
 - The bacteria break down all bio-degradable solids.✓
 - If there are no bacteria in your system it will simply act as a holding tank for waste.✓
- (3)

6.6 Function of a GPS device as installed on a tractor.

Precise location✓ and accuracy in the application of seeds/fertilizer.✓

(2)

6.7 The role of irrigation software in crop production.

- Software can be used to control water, turning it on and off.✓
 - Control how much water is delivered at any given time.✓
 - Irrigation software can also be programmed to manage the delivery of liquid fertilizer products.✓
 - Can respond to ongoing weather conditions with automatic reprogramming.✓
 - Provides continuous feedback✓ and keep statistics and data.✓
- (Any 5) (5)

6.8 The name of each of the water purification systems as described.

6.8.1 Distiller / Distillation.✓ (1)

6.8.2 Reverse osmosis.✓ (1)
[30]

TOTAL SECTION B: 160
GRAND TOTAL: 200